

Complexity Science mini-project proposal 2011-12

Project title: Assessing behaviour of *C. elegans* through video analysis using a worm tracking system.

Background: *Caenorhabditis elegans* is a free-living, transparent nematode (roundworm), about 1 mm in length, which lives in temperate soil environments [1]. Research into the molecular and developmental biology of *C. elegans* was begun in 1974 by Sydney Brenner and it has since been used extensively as a model organism. It is desired to objectify measures of behaviour of *C. elegans* through automated analysis of video microscopy. Our lab recently finished designing and assembling a low cost worm tracking station. This consists of a low-cost microscope video (connected to PC via USB) mounted on an articulated arm with 2 servo motors, giving 2 degrees of freedom covering a horizontal plane. The aim is to monitor the video output in real time and move the microscope/camera to keep the worm in the centre of field of vision.

Objectives: The objectives of this project are to: a) read camera image through USB on PC (Matlab preferred at this stage); b) identify worm in image and locate centre of mass of worm in image; c) track worm as it moves across field of view; d) when worm moves out of defined boundary, calculate transform to move both servos to re-locate camera such that worm is in centre of field of view; e) do a performance analysis of the system developed to assess suitability/ fitness for purpose.

What the student will do:

- a) Familiarise themselves with the system designed and the access of images/ control of servo-motors.
- b) Run simplistic trials in the Neural Engineering lab on worm samples.
- c) Develop data analysis algorithm to locate worm centre of mass in image.
- d) Track worm across subsequent captured images.
- e) Develop appropriate transform to move servo-motors such that the worm is return to centre of field of view following an appropriate trigger.
- f) Assess performance of the system and present results.

Possible PhD project:

There is much scope for continuing this project into a PhD, there is a clear need to have a low-cost, portable, worm trackers – applications could venture into drug testing/ drug discovery etc. Once a worm tracker is fully functioning the analysis of worm behaviour through observed patterns is very pertinent and will advance worm research by leaps and bounds.

References

[1] Wood, William Barry (1988). "Chapter 1: Introduction to *C. elegans* Biology". In Wood, William Barry. *The Nematode *Caenorhabditis elegans**. Cold Spring Harbor Laboratory Press. p. 1. ISBN 0-87969-433-5.